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Integrated constraints on saltwater intrusion dynamics in a river–coastal system: the Volturno River (southern Italy)

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Saltwater intrusion in coastal plains is commonly investigated through single-discipline approaches, often focusing either on groundwater systems or on coastal dynamics. In low-gradient, microtidal river–coastal settings, however, river channels may act as efficient pathways for saline water propagation, significantly influencing mixing processes between marine, fluvial and aquifer compartments (Ferguson & Gleeson, 2012).

Here we present initial integrated constraints on saltwater intrusion dynamics along the Volturno River (southern Italy), derived from new field data collected within the ongoing SAL.WE. project, a joint research initiative between CNR–ISMAR and the Southern Apennines District Basin Authority. The study integrates repeated vertical salinity profiling along the Volturno river channel with recently acquired subsurface and geological information and enables direct comparison with earlier geophysical surveys carried out at the same locations (Tarallo et al., 2023), providing insight into the temporal evolution of the system.

The first results reveal the development of a salt-wedge structure within the river channel, with saline waters occupying near-bottom layers and extending several kilometres inland beneath a freshwater surface flow. Vertical salinity gradients, halocline depths and inland penetration vary along the river course, reflecting the combined influence of channel morphology, sedimentary architecture and hydrological conditions. These observations are consistent with density-driven circulation and stratification processes described for microtidal systems (Geyer & MacCready, 2014) and with subsurface salinity patterns inferred from complementary datasets.

Although the project is still ongoing, these early findings demonstrate the value of integrated observations for constraining saltwater intrusion processes beyond single-method assessments. The Volturno River case provides a process-oriented framework applicable to other Mediterranean and microtidal river–coastal systems experiencing increasing salinization pressure.

References

Ferguson, G., & Gleeson, T. (2012). Vulnerability of coastal aquifers to groundwater use and climate change. Nature Climate Change, 2, 342–345.

Tarallo, D., et al. (2023). Geophysical assessment of seawater intrusion: the Volturno Coastal Plain case study. Applied Water Science, 13, 234.

Geyer, W. R., & MacCready, P. (2014). The estuarine circulation. Annual Review of Fluid Mechanics, 46, 175–197.